REMARKS

Claim 20-23 and 27-30 have been canceled, leaving claims 1-19, 24-26, and 31-38 pending in this application. Each of these claims stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,098,487 issued to Brauer et al.

In paragraph 3 of the Office Action, the Examiner describes Brauer et al. as showing a die casting method that includes the steps of:

1. cooling a molten metal in a vessel;
2. stirring the same with either a mechanical means or an electromagnetic means;
3. to form a semi-solid slurry; and
4. discharging the slurry into a casting chamber.

The Examiner goes on to state that, in his opinion, it would have been obvious to omit any induction heating means as part of the casting chamber by simply increasing the insulation or the insulation thickness in the surrounding wall in order to prevent solidification of the slurry.

In paragraph 3 of the Office Action, the Examiner elects to discuss some of the specifics with regard to claims 2-8 and 26, suggesting that the casting cycle time and the desire to optimize that casting cycle time is something that would have been obvious to obtain through routine experimentation. Additionally, claims 9 and 16, claims 17-19, and claims 31 and 38 are mentioned with much the same assessment, namely that the specific elements recited in those claims are features or characteristics or steps that, in the opinion of the Examiner, would be obvious to a person of ordinary skill in this art. Since the

Examiner has specifically commented with regard to claims 9, 16, 17, 18, 19, 31, and 38, we should also note that there are no specific comments with regard to claims 10-15, 25, 32-34, and 36. Since these other claims are not specifically discussed, nor are their claim elements specifically mentioned, one would have to assume that the Examiner's summary of Brauer et al., noting the four steps mentioned above, is intended to suffice as a basis for rejection of these claims. However, since the elements of these claims are not included in those four steps and since there is no additional discussion nor any additional references provided, nor any indication that those claim elements would be obvious, it would appear that these claims should be allowed. Further, claim 31 recites the step of changing the voltage level and this is not disclosed by Brauer et al. Claim 35 recites the use of a covering cap to permit the use of an inert gas and this is not disclosed by Brauer et al. Claim 37 recites the use of a thermal jacket and this is not disclosed by Brauer et al.

Since Brauer et al. does not anticipate the claimed invention, various assumptions have to be made by the Examiner as to what might be obvious. One such assumption is that the induction heating means referenced for the casting chamber (70) can be omitted if the insulated walls are sufficient to prevent solidification of the slurry. Whether or not the casting chamber (70) includes induction heating means or only thicker, higher R-value insulated walls, the reality is that the "slurry" that is gradually deposited into the casting chamber (70) must be heated or at least must have its cooling rate reduced in order to prevent solidification of the slurry. The mere fact that solidification of the slurry is a significant concern of Brauer et al. confirms the "gradual" nature of depositing slurry into the casting chamber (70). As the first portion of slurry trickles out of opening (66) into the casting chamber (70), there is a concern that this initial portion of slurry could

solidify while waiting on additional slurry to accumulate into an adequate shot size for the particular part to be cast. The "gradual" nature of depositing slurry into the casting chamber (70) is supported by statements within Brauer et al., specifically in Column 8, at lines 35-46. The reference at this point to "when a sufficient quantity of slurry is in the die cavity 70", clearly and convincingly teaches that the "sufficient quantity" is not provided in one mass, as a single shot "slurry billet". Instead, the required volume of slurry is deposited by way of a continuous flow coming through opening (66) as illustrated in FIG. 6 of Brauer et al. Since the only path for slurry to exit from apparatus (58) is by way of opening (66), it is clear that the slurry gradually flows into the casting chamber (70).

While the first portion of slurry sits in the casting chamber (70), any cooling must be minimized in order to prevent solidification of the slurry. Assuming a relatively low trickle of slurry by way of opening (66), the time required in order to achieve the desired volume of slurry could indeed require the need for "induction heating means" as disclosed in Brauer et al. While the Examiner is apparently not prepared to accept that Brauer et al. includes a heating step subsequent to discharging the slurry from the slurry apparatus (58), there is no doubt that the Brauer et al. patent discloses this feature as something that could be required.

Another concern with regard to what Brauer et al. purports to disclose relates to the referenced "cooling step" recited in all of Applicants' claims. The Examiner has characterized Brauer et al. as including the step of "cooling" a molten metal in a vessel. However, there is not only no teaching nor any suggestion of this cooling step, but Brauer et al. actually teaches just the opposite, i.e., heating. Considering the FIG. 6 illustration

and column 8 of the patent specification of Brauer et al., all we know is that molten metal is transferred to system (58) by launder (56) and that induction heating coil (64) "**maintains** the temperature of the stirring chamber close to the solidification temperature of the alloy". There is no disclosure of any "cooling" step, only a heating step to **maintain** the temperature close to the solidification temperature of the alloy. The term "maintains" in this context means "to keep in a specified state" while "cooling" means to "lessen" as in the case of a temperature. Maintaining the alloy at a specified state is not equivalent to lessening or lowering of the temperature of the alloy which would actually change the specified state rather than maintain it. Applicants claim a cooling step and Brauer et al. discloses just the opposite, a heating step to maintain a specified state.

An important feature of the claimed invention and one that is recited in the claims includes the reference to a "slurry billet". This particular terminology was not carelessly selected nor selected by chance. As is clearly set forth on the very first page of the application, we define that "slurry" and "billet" and "slurry" and "single shot" have been combined in the application to represent "a volume of slurry which corresponds to the desired single shot billet". When the claims of the present application recite a "slurry billet", this is not by chance. We are clearly defining a single shot volume of slurry that represents the desired amount for the particular casting task. The ability to handle this volume of slurry as a "billet" means that its solid fraction percentage is high enough for the "billet" to hold enough of its form to be discharged into the shot sleeve as a single shot volume. Brauer et al. does not in any way, shape, or form contemplate the creation of nor the discharge of a "slurry billet". The gradual flow of slurry out of opening (66) as

disclosed in Brauer et al. is in fact just the opposite and, by its very nature, precludes the possibility of any type of "slurry billet" ever being formed or handled.

There is no issue that what FIG. 6 of Brauer et al. is intended to depict is a conventional rheocasting apparatus. As stated in Column 8, lines 17-18, "FIG. 6 illustrates a casting apparatus for rheocasting liners for shaped charged devices". Some of the particulars of rheocasting are discussed in the Background of the subject patent application. Referring specifically to page 3, it is noted that the "major barrier" in rheocasting is being able to generate sufficient slurry within the preferred temperature range in a short cycle time. This "major barrier" is clearly not solved by Brauer et al. There is no short cycle time in Brauer et al. and the required volume of slurry for the cast part is gradually deposited in the casting chamber (70) over some time span. While we wait for the requisite volume of slurry to be accumulated in the casting chamber (70), the overall cycle time is lengthened and there are additional demands, such as subsequent heating of the (early) slurry portion so that the slurry can, at a later time, be cast. If all of the slurry required for the particular cast part would be deposited in the shot sleeve as a single shot slurry billet, then effectively the temperature and composition of that slurry billet would be virtually the same throughout and could be cast immediately upon discharge into the shot sleeve without any time delay and without the risk of slurry solidification. Since Brauer et al. does not disclose the discharge of a "slurry billet", it is clear that the slurry arrives in the casting chamber over some period of time and obviously this time span is long enough for concerns to be raised that the initially deposited portion of slurry could solidify and, for that reason, subsequent heating is required.

The present invention solves the rheocasting problem by creating a slurry billet that has the dual benefit of a shorter cycle time and less complexity to the overall casting apparatus.

With regard to those claims that recite specific time intervals, the Examiner believes that it would be obvious to obtain the optimal casting cycle time through routine experimentation. Applicants disagree. The perception that there is some "optimal" cycle time misunderstands or mischaracterizes the present invention. What is described is a desire to strike a balance between the quality and uniformity (non-porosity) of the final cast part with a cycle time that is as fast as possible without compromising the part quality. The importance of a shorter cycle time or faster processing is to enable the overall part through put for a mass production operation to be maximized. While it might be possible to create a slurry billet of some composition faster than the time ranges indicated in the present application, if the quality of the cast part is unacceptable, the overall process is not "optimal".

What the claimed invention recognizes is that the quality of the final cast part can be optimized while still processing that cast part in a shorter overall cycle time compared to prior art processes. One of the features of the claimed invention is the creation of the recited slurry billet and the creation of this slurry billet by the use of electromagnetic stirring. Another feature is the immediate and direct discharge of the slurry billet into the shot sleeve as a single shot volume. This is not something that the apparatus disclosed in Brauer et al. is capable of achieving. The gradual flow of slurry into the casting chamber (70) prevents the achievement of any type of shortened cycle time. The only way to achieve the claimed invention with Brauer et al. as the starting point is to completely

redesign Brauer et al. This obviously would require a large degree of hindsight speculation, a practice that is not appropriate for Examiners. Accordingly, claims 2-8 and 26 that include specific time ranges are believed to be independently patentable based upon these recited time intervals. Not only is there no disclosure in Brauer et al. of any type of time criticality or time interval importance, the Examiner has not provided any other reference to supplement this deficiency, nor has the Examiner provided any other reference in support of his personal opinion that it would be obvious to obtain optimal casting cycle times through routine experimentation. If such a step is obvious, then any number of relevant prior art references should be available to document that contention.

Since the Brauer et al. reference does not provide any suggestion or teaching that cycle times are important, the applicable case law compels the Examiner to allow claims 2-8 and 26 on this basis alone. As is believed to be well known, the applicable case law requires, under 35 U.S.C. §103(a), that at least one of the references being combined must provide some suggestion or teaching of the particular combination being made by the Examiner. Obviously this suggestion or teaching is missing in Brauer et al. and cannot be supplemented by the Examiner's personal opinion as to what might be obvious to one of ordinary skill in the art. As indicated, at a minimum, the Applicants are entitled to have the Examiner cite a relevant prior art reference that suggests the importance of shortening the cycle time without compromising the quality of the cast part.

The Examiner also specifically mentions claims 9, 16-19, 31, and 38 with regard to the elements recited in those claims and the belief that it would be obvious to provide those recited elements to the Brauer et al. structure. Here again, the Examiner is

requested to cite relevant prior art in support of his opinion that these particular claim elements would be obvious to a person of ordinary skill in the art.

While claims 10-15, 25, 32-34, and 36 are generally rejected under 35 U.S.C. §103(a) based upon Brauer et al., there is no discussion by the Examiner of these claims. If we look at the four steps identified as being disclosed by Brauer et al., there is no specific mention of any of the elements recited in these various claims. Arguably, the fact that there is no discussion of these claims in the Office Action is the result of the fact that there is no disclosure of these various elements in Brauer et al. Since there is absolutely nothing in Brauer et al. that discloses or suggests any of the elements recited in these claims, these claims should be allowed.

Based upon the foregoing remarks and analysis as provided herein, and based upon the various deficiencies of the Brauer et al. patent, and based in part on the lack of any relevant prior art to satisfy or supplement the Brauer et al. deficiencies, claims 1-19, 24-26, and 31-38 are in condition for allowance and are respectfully requested to be pass to issue.

Respectfully submitted,

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